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BEE-GATHERED POLLEN IN VARIOUS LOCALITIES ON THE PACIFIC COAST

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A study has been made of the gathering of pollen by bees and data of yields obtained from pollen traps in 39 western localities. The results indicate certain localities where trapping of pollen in quantities for commercial use might be feasible.

The whole subject of a bee-collected supply of pollen and the uses of such pollen is essentially new. A simple trap for removing the pollen loads from the incoming bees of a colony has been devised. The use of pollen in feeding bees for colony build-up has progressed past the experimental stage. There is, as yet, little commercial pollen available. The current equipment for and the process of trapping pollen, as well as the role of pollen in the economy of the hive, have been discussed in other publications (1, 3).

The quantity of pollen available in a locality has an important bearing on beekeeping possibilities. For example, the Sacramento Valley of California, which has a tremendous supply of pollen from deciduous fruits and other sources with which to rear bees, is therefore the important package-bee-producing area of the West. On the other hand, in the Pahvant Valley around Delta, Utah, the pollen sources are so limited that it is difficult to build colonies for the alfalfa honey flow. Even after the alfalfa comes into bloom, the pollen supply is very limited. The bees, in that case, are usually moved out to other places having more pollen for the spring build-up.

A good colony needs 40 or more pounds of pollen to maintain optimum brood rearing during a year. The rearing of a frame of brood requires about a frame of pollen. The low pollen income at some hives where traps are set shows the need for the feeding of additional pollen or pollen supplements. When pollen is scarce, bees may collect the spores of a number of fungi and use them for brood rearing. No satisfactory complete substitute for pollen has been found, however. Soybean flour has value as a supplement to pollen, even though it is not a complete substitute.

Not all pollens are of equal nutritive value. The chemical constituents vary widely. For example, the protein content among 32 samples analyzed by Todd and Bretherick (2) ranged from about 7 to 30 percent, and the fat content from less than 1 to more than 14 percent. Corn

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pollen had more than 22 percent of starch, whereas pollen from some sources had none. It is evident from the variation in constituents that larger quantities of some kinds of pollen would be required to rear a pound of bees.

A trap does not remove all the pollen, but its yield indicates the available field supply. Incomplete trap records from 39 widely separated localities in the Pacific Coast States have been secured. These trap records show the general importance of some pollen-producing plants regardless of locality. The relative value of the plants is learned from a study of the trapped pollen.

At each locality the trap was alternated between two similar colonies at intervals of about 10 days, in order that colony strength and a steady pollen income could be better assured. The pollen was usually removed from the traps daily. It was mailed periodically to the laboratory for weight and other determinations. The weights are for air-dried pollen; dried pollen weighs about 20 percent less than fresh.

The pollen trapped per colony from 18 localities during the active season ranged from about 9 to 70 pounds. The yield data for these and other localities for shorter periods are presented in table 1. Although the trapping records covered a period of 8 years, in some of the records a gap of 2 to 6 weeks occurred during the collection time; thus the data are not so valuable for direct comparison as for a general indication of the pollen productivity of a locality. However, where traps have been operated in more than 1 year in the same locality the seasonal trends have been somewhat similar, especially in the periods of the maximum and minimum yields. For example, the seasonal yields at Hanford, Calif., during 2 years have been less than one-fourth of those at Davis. Both places had two peaks, one early and one late - a factor which may be rather general, since many places have an increase in flora following the hot summer period.

Figure 1 illustrates graphically the radical difference in pollen income between eight localities. In five of these localities, where complete records were obtained for the period April through September, the seasonal yields ranged from about 8 to 51 pounds. The August and September yields for Ashland are for a previous year, because in 1943 the trap colony failed.

An interesting record was obtained in a deciduous-fruit area near Vernon, British Columbia. The total income from April to early October was 14,511 grams, or 32 pounds. The income for the biweekly periods is shown in figure 2. The maximum yield was obtained during the deciduous-fruit blossoming time in May.

In 1944 the same trap was again operated during fruit-blossoming time. Comparative data on the daily production for 20-day periods in both years are presented in table 2. The total amounts differ by only 727 grams, or 1 pound 9 ounces.

Table 1.—Grams of pollen collected per day at various localities from 1937 to 1944

Locality	January	February	March	April	May	June	July	August	September	October	November
Arizona:											
Chandler	32	23	18	51	59	69	67	31	101	11	12
Phoenix	-	-	128	95	98	-	-	-	-	-	-
Tucson	-	-	56	23	28	19	18	18	43	-	-
Yuma	33	53	50	145	-	-	-	-	-	-	-
British Columbia:											
Vernon	-	-	-	68	177	79	107	53	17	2	-
California:											
Black Star Canyon	-	-	26	69	32	181	131	13	8	10	-
Brawley	35	63	65	49	47	28	20	15	39	12	2
Camino	-	-	-	-	-	35	16	23	15	-	-
Courtland	-	-	-	-	-	67	-	-	-	-	-
Davis	-	24	120	178	117	75	101	95	90	22	-
Glenn	-	-	-	-	82	-	-	-	-	-	-
Hanford	-	28	30	42	13	16	14	18	20	13	-
Lassen Park	-	-	-	-	-	-	-	30	36	-	-
Lindsay	-	-	-	-	35	-	-	-	-	-	-
Mineral	-	-	-	-	-	141	147	36	39	16	-
Oakdale	-	-	243	-	-	-	-	-	-	-	-
Orange	14	10	22	39	48	112	133	34	47	20	13
Paynes Creek	-	-	-	132	48	-	-	-	-	-	-
Placerville	-	-	11	185	40	26	22	31	19	8	-
Santa Paula	-	14	17	31	60	-	-	-	-	-	-
Santa Rosa	-	-	164	194	-	-	-	-	-	-	-
Santiago Canyon	-	-	-	-	-	-	-	4	-	-	-
Tuolumne	-	-	32	55	87	76	31	40	25	25	-
Winters	-	-	139	209	-	-	-	-	-	-	-

Table 1.--Continued

Locality	January	February	March	April	May	June	July	August	September	October	November
Nevada:											
Carson valley	-	-	-	42	121	192	67	153	-	-	-
Fallon	-	-	35	45	20	45	56	52	37	10	0.2
Mason valley	-	-	-	47	45	43	51	35	-	-	-
Reno valley	-	-	-	101	65	54	50	53	-	-	-
Oregon:											
Ashland	1	4	25	54	88	80	83	61	23	7	-
Corvallis	-	3	34	72	132	58	44	9	5	1	10
Birkenfeld	-	-	70	27	23	-	-	-	-	-	-
Junction City	-	-	-	47	76	53	35	20	20	-	-
Silverton	-	-	-	-	-	41	267	-	-	-	-
Stanfield	-	-	-	-	41	289	31	29	13	5	-
Utah:											
Delta	-	-	-	-	-	-	20	18	-	-	-
Deweyville	-	-	-	-	-	-	29	43	-	-	-
Logan	-	-	-	-	-	-	54	109	-	-	-
Petersboro	-	-	-	-	-	-	-	80	-	-	-
Smithfield	-	-	-	-	-	-	56	186	-	-	-

Table 2.—Grams of pollen trapped daily during deciduous-fruit blooming time, Vernon, British Columbia, 1943 - 44

Date (May)	1943	1944
1	53	42
2	90	15
3	150	58
4	17	140
5	200	160
6	-	165
7	225	127
8	233	74
9	153	40
10	81	90
11	221	173
12	180	266
13	156	303
14	396	302
15	381	231
16	378	370
17	356	331
18	420	350
19	399	271
20	207	60
Totals	4,294	3,567
	(9 lb.)	(8 lb.)

The pollen income throughout a day is not constant. The comparative abundance of a particular source partly determines the time when most of the pollen is gathered. Detailed data on a trap yield at Davis, Calif., for August 5, 1940, are shown in figure 3. The pollen tray was emptied every 2 hours for ascertaining the weight and kinds of pollen. Corn pollen was present in the samples until 10 a.m., and orchard morning-glory until noon. About 85 percent of the total 91 grams of pollen was from yellow star-thistle and California-poppy. These pellets arrived throughout the collection period, as did a small number from Ladino clover. Since most of the pollen arrived between 9 a.m. and 2 p.m., a trap operated only during this portion of the day would not interfere with colony activity and still would obtain most of the supply. The best time of day for trapping at any location can be easily ascertained.

The curve showing pollen-trap yield (fig. 3) is strikingly similar in trend to a graph showing the activity of honey bees on Bartlett pear blossoms at Camino, Calif. (Vansell, 4). Only pollen-collecting bees

visited the Bartlett blossoms, because nectar was practically absent. The data were obtained by counting the visitors to the trees, for a pollen trap was not yet available at that time.

Some plants greatly surpass others in value as sources of pollen. The percentages of the different kinds of pellets found in a sample indicate the relative values of plants during any period. Such data on an aliquot from 915 grams of pollen trapped at Ashland, Oreg., from July 10 to 22, 1944, have been classified as to color and source (table 3). More than 65 percent of the total was from yellow sweetclover. Earlier in the season dandelion would have been prominent. Although alfalfa was available in the locality, none of its pollen was found in the sample.

Table 3.--Kinds of pollen from a trap operated at Ashland, Oreg., July 10 - 22, 1944

Color	Source	Percent by weight
Dark yellow brown	Yellow sweetclover	64.6
Light yellow brown	Yellow sweetclover and poppy	23.3
Grayish green	Unknown	5.7
Medium brown	Unknown and poppy	4.2
Dark brown	Dandelion	1.3
Greenish yellow	Cattail	.9

Some of the best pollen sources are almond, apple, apricot, asparagus, balsam root, bluecurls, cactus, California-poppy, Canada thistle, Ceanothus (many kinds), clovers (especially yellow sweetclover), corn, cottonwood, dandelion, elm, filaree, gumweed, linden, maple, mesquite, mustard (many kinds), olive, peach, pine, pistachio, plum, redmaids, redwood, spikeweed, walnut, willows, and yellow star-thistle. Alfalfa, fireweed, lima bean, manzanita, milkweed, orange, Scrophularia, and snowberry - all good honey sources - are of limited value as sources of pollen, especially when they occur with better pollen sources. The navel-orange blossom has no pollen. Some plants, such as chicory, greasewood, morning-glory, some tarweeds, and wild lettuce, shed pollen only during a short period of the day, whereas some of the most important ones are available throughout the day. The bees frequently show a decided preference for specific kinds of pollens, but most of the factors which govern their selection are obscure. Honey bees seldom collect pollen from chamise, cattail, and cotton, although these plants are very prolific pollen producers.

The trap data, as well as a study of the plant sources, indicate that the following are generally poor localities for pollen gathering: Imperial and San Joaquin Valleys in California, the Reno and Mason Valleys in Nevada, and the Pahvant Valley in Utah. The Willamette Valley

of Oregon is poor after late June, but good during spring and early summer if weather permits field activity. The Lahontan Valley in Nevada appears to be medium in pollen productivity. Among the better areas are the Sacramento Valley and Sierra Nevada Mountains in California; Vernon, British Columbia; the Umatilla Valley and the Rogue River Valley in Oregon; the Cache Valley in Utah; and the Carson Valley in Nevada.

This paper may be summarized as follows: (1) Bees require and collect a surprisingly large amount of pollen. Even where 50 pounds were trapped there was no surplus. (2) The amounts of pollen produced in 39 different localities vary greatly and some places - for example, the fireweed area of Oregon and Mason Valley in Nevada - are deficient in this important material essential for beekeeping. (3) Some plants, such as mustard, deciduous fruits, dandelion, willows, thistles, are of major importance as sources of pollen wherever found.

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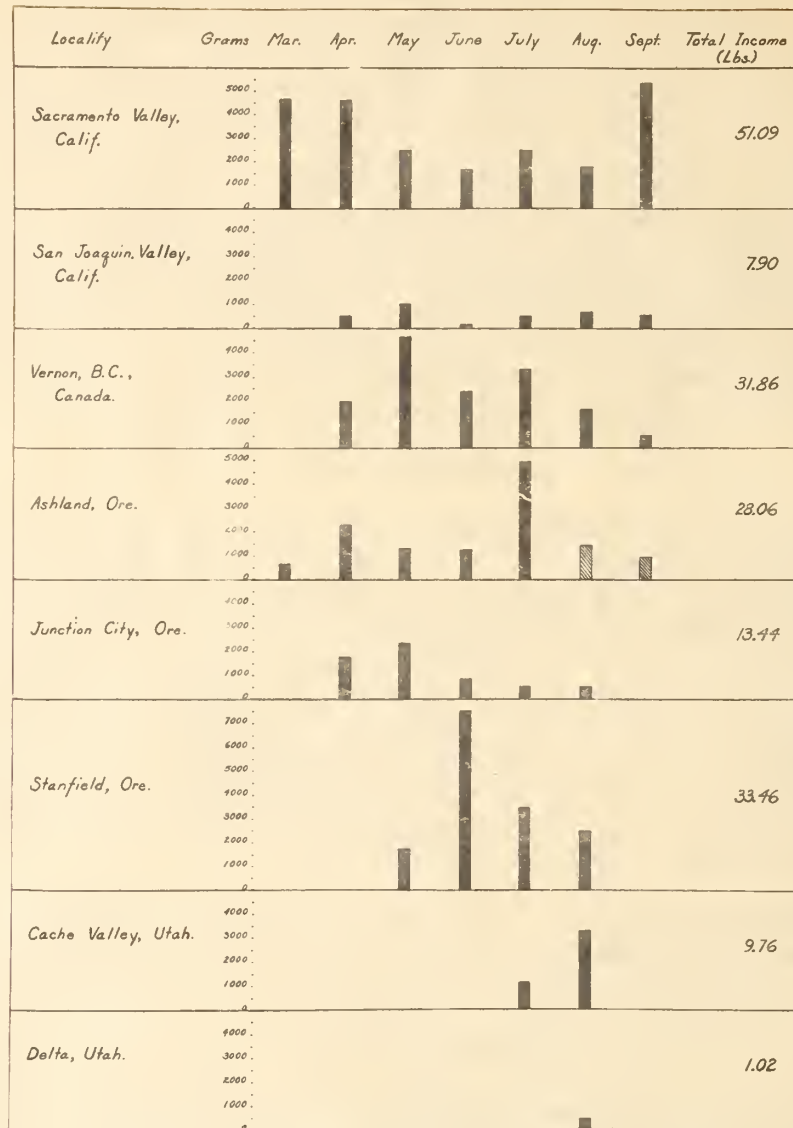


Figure 1.—Comparative pollen income by months at several localities in 1943.

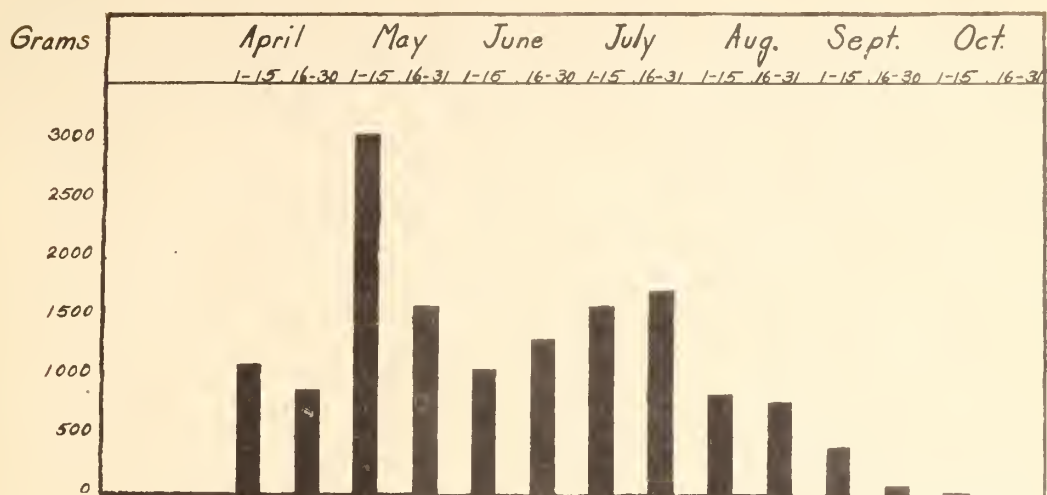


Figure 2.—Semimonthly income of pollen collected in traps at Vernon, British Columbia, for 1943.

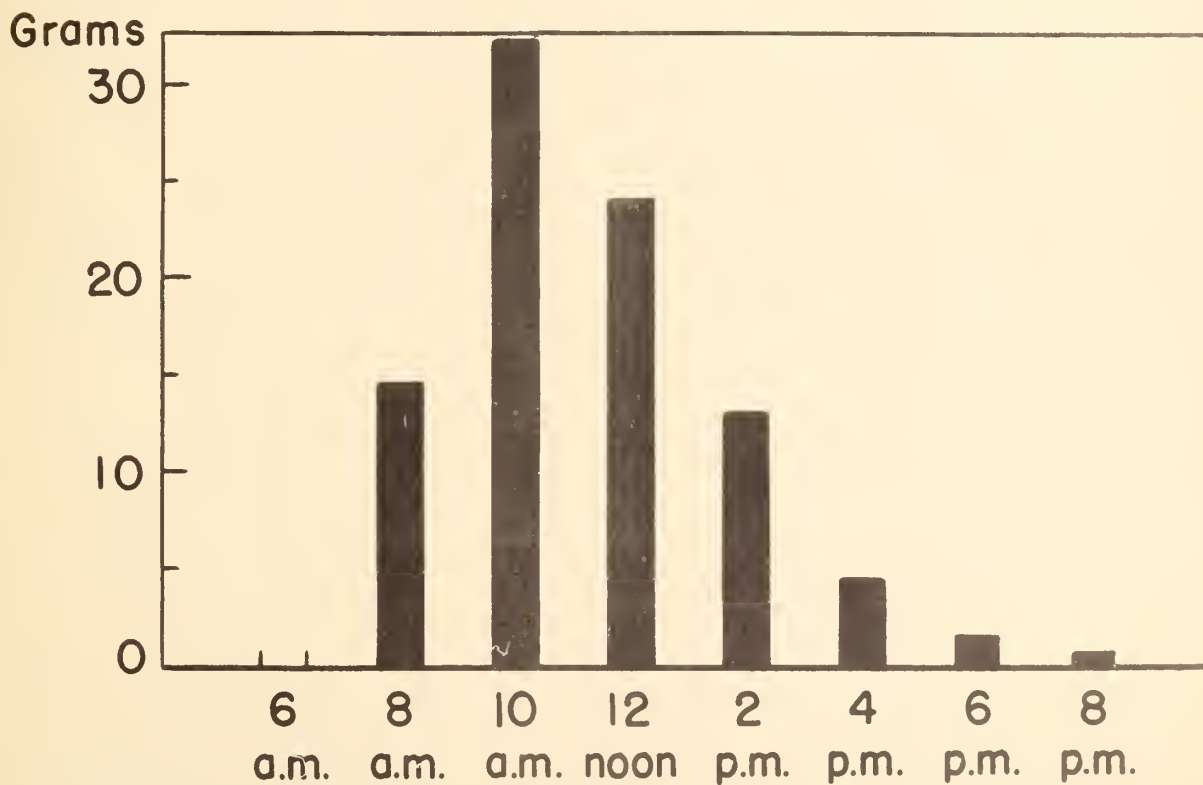


Figure 3.—Pollen collected at 2-hour intervals during one day at Davis, Calif., 1940.

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